Webbed Solar Array, Phase I

Completed Technology Project (2018 - 2019)

Project Introduction

Proposed is a new PV array architecture (featuring up to or beyond 1000-1500~m2 surface area) which can autonomously and repeatedly self-deploy into a disk-like configuration from a vertical Mars lander or other equipment, fully independent of terrain, while naturally achieving highly prioritized operational Mars mission objectives. The innovation offers an attractive alternative to other designs for which integration with launch vehicle and lander/habitat structures is less than seamless, cleaning, deployment, and environmental effects can be an operational bottleneck, and structural support may depend on the terrain.

The webbed array is a fundamentally new hierarchical tension-compression paradigm with a compression ring suspended from an elevated central platform with lanyards, and a network of catenaries and webbings connecting it to the hub. The webbings support the actual array surface which constructed of flexible PV surface strips. For stowage, the webbings, catenaries, and surface together wrap onto a rotating drum in the central hub, with the compression ring gradually collapsing and the suspension lanyards reeled in. Stowage is compact and holds the sensitive PV surface in the tight embrace of mechanical parts from all directions.

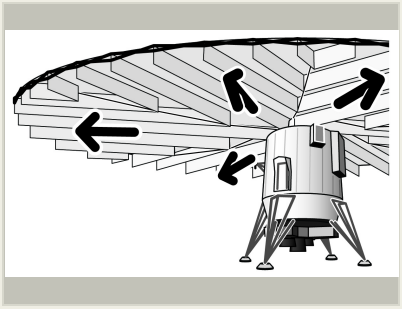
The surface structure is slack when deployed with cross-slopes and gaps for self-cleaning, which is further assisted by dynamical excitation by winds. Elevation above the terrain is natural. Integration with the piece of heavy base equipment anchors the array down to resist winds. Sun tracking is possible. Adaptive operation permits partial or full retraction when needed for protection or to control risks in special events (e.g., tornado / dust devil updraft).

Offered is a systematic mapping of the several new fronts opened by this technology, to identify technological needs and paving the way for further development and commercialization.

Anticipated Benefits

Autonomously deployable/retractable elevated surfaces in gravity
- Mars power infrastructure: self-cleaning PV arrays
- Shading protection
- Other planetary missions
- Lunar missions

Autonomously deployable/retractable elevated surfaces in gravity
- Private sector planetary / Lunar missions
- Earth-based PV arrays in scenarios without human presence



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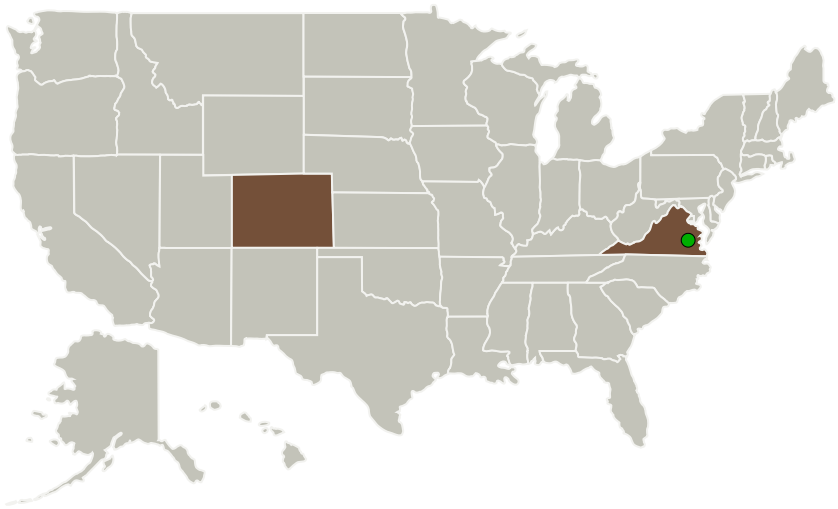
- Rapidly deployable/retractable elevated shades and covers for protection or concealment in architectural and military applications

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
TentGuild Engineering Company	Lead Organization	Industry	Boulder, Colorado
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Colorado	Virginia

Project Transitions

July 2018: Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

TentGuild Engineering Company

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

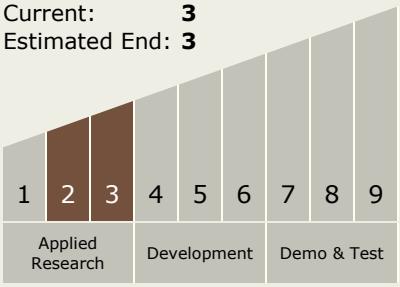
Carlos Torrez

Principal Investigator:

Gyula I Greschik

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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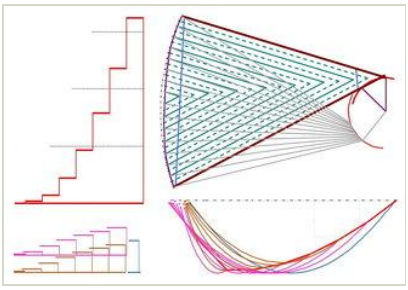
February 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/141367)*

Images

Briefing Chart Image
Webbed Solar Array, Phase I
(https://techport.nasa.gov/image/131104)



Final Summary Chart Image
Webbed Solar Array, Phase I
(https://techport.nasa.gov/image/131023)

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.4 Manufacturing
    - TX12.4.1 Manufacturing Processes

Target Destinations

The Moon, Mars, Others Inside the Solar System